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FLOOD INSURANCE STUDY



CITY OF SIDNEY,
OHIO
SHELBY COUNTY



MAY 17, 1982



Federal Emergency Management Agency

COMMUNITY NUMBER - 390507

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PUBLISHED SEPARATELY:

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FLOOD INSURANCE STUDY

CITY OF SIDNEY,
SHELBY COUNTY, OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Sidney, Shelby County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Sidney to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Louisville District, for the Federal Emergency Management Agency, under Inter-Agency Agreement No. IAA-H-9-79, Project Order No. 30. This study was completed in January 1981.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, FEMA and representatives of the City of Sidney in May 1979. Results of the hydrologic analyses were coordinated with the Ohio Department of Natural Resources.

On December 16, 1981, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Sidney, Shelby County, Ohio. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction for the next five years, through January 1986.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Sidney.

The limits of detailed and approximate studies in the City of Sidney were determined by FEMA with community and Study Contractor consultation at the meeting in May 1979.

Floods caused by overflows of the Great Miami River and Tawawa Creek were studied in detail within the corporate limits. Tilberry Run, Wells Creek and an Unnamed Tributary of the Great Miami River were studied by approximate methods.

2.2 Community Description

The City of Sidney is surrounded by the unincorporated areas of Shelby County. Shelby County is located in west-central Ohio and occupies 261,056 acres or 407.9 square miles. Sidney, the county seat and only city, is located slightly southeast of the center of the county and had a 1980 population of 17,658, an 8.1 per cent increase over the 1970 population of 16,332 (Reference 1).

Sidney was founded in 1819 as the seat of justice and principle town of Shelby County. The original plat, which comprised 70 acres on the west bank of the Great Miami River, was donated to the county by Charles Sterrett for the purpose of permanently locating the seat of justice.

During Sidney's early period, its growth was slow. In the mid-1800's, the construction of the Bellefontaine and Indiana Railroad and the Dayton-Michigan Road spurred a steady growth in population and industry in the city.

The climate of Sidney is classified as continental. Such a climate is marked by large annual, daily and day-to-day ranges in temperature. Summers are moderately warm and humid with occasional days when temperatures exceed 90 degrees Fahrenheit. Winters are reasonably cold and cloudy with an average of seven days with subzero temperatures. Precipitation in the county varies widely from year to year. However, it is normally abundant

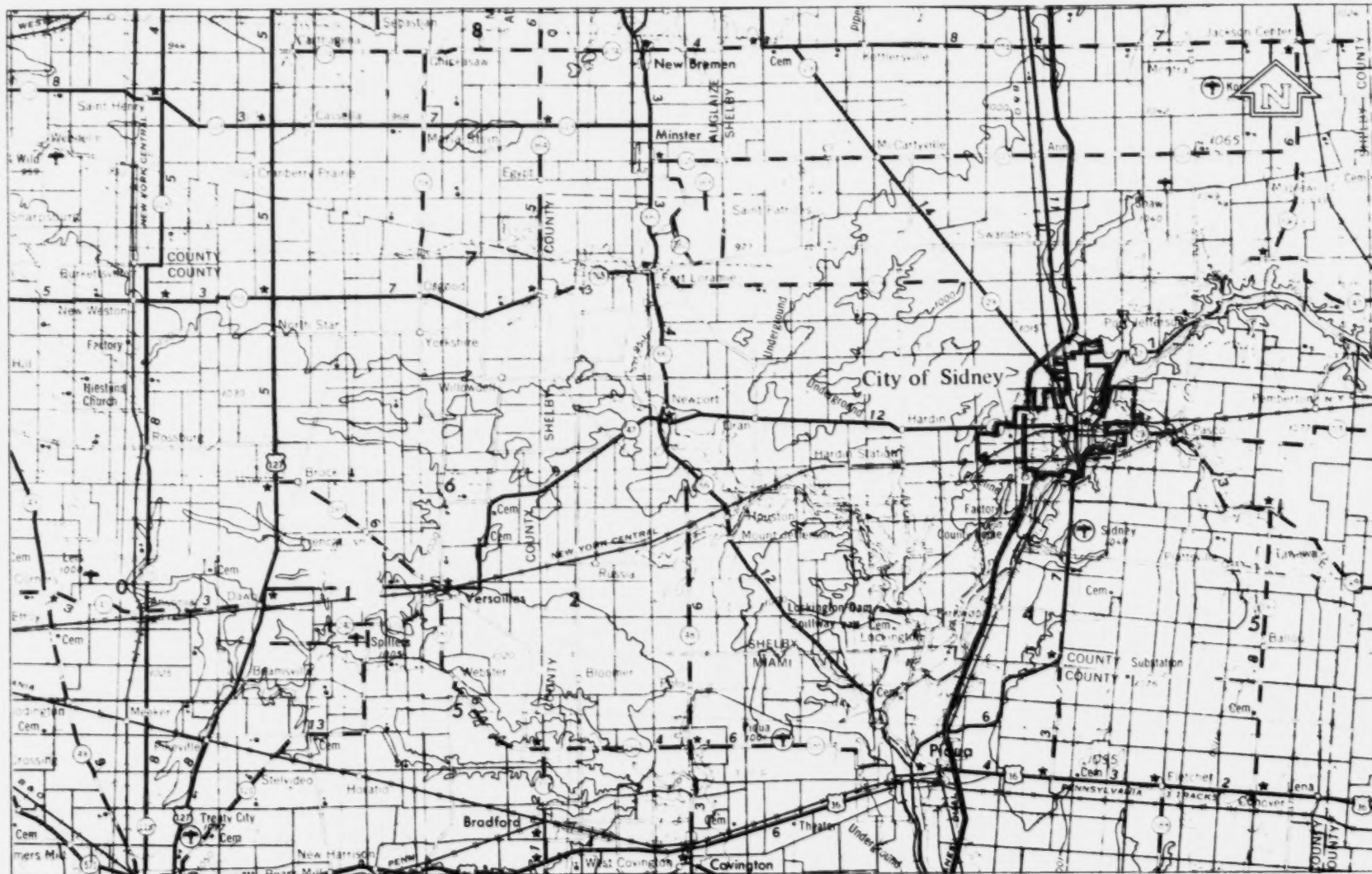


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SIDNEY, OH
(SHELBY CO.)

APPROXIMATE SCALE



VICINITY MAP

and well distributed throughout the year, with fall typically being the driest season. The average annual precipitation is 36.24 inches. Showers and thunderstorms account for most of the rainfall during the growing season. Thunderstorms occur on about 40 days during the year and are most frequent from April to August. Snowfall in the county may fluctuate widely from the annual average of 24 inches (Reference 2).

Sidney lies entirely within the Wisconsin Age glaciated region of Ohio. Wide, low and slightly hummocky ridges called end moraines were built up where the glacier remained stationary for a period of time. All or parts of six end moraines extend across the county. Boulders associated with the Farmersville end moraine are a common occurrence in the southeastern corner of the county (Reference 2).

The Great Miami River and its tributaries drain most of the county except for a small area in the northwestern part. This area drains northward into tributaries of the Maumee River. Elevations in Shelby County range from a high point of 1,150 feet in the southeastern corner to a low of 870 feet where the Great Miami River enters Miami County on the south (Reference 2).

Farming dominated by livestock production and cash grain cropping is the major land use in the county. The major cash crops grown are soybeans, corn, wheat and oats. Truck, nursery and specialized crop production is an additional enterprise of some importance. An increasing amount of land around the City of Sidney is being used for nonfarm land use development (Reference 2).

2.3 Principal Flood Problems

Floods may occur in Sidney during any season of the year. However, past flood records of streams within the area indicate that the majority of severe flood events have occurred during January to May. Flooding may result from both periods of general rainfall over the entire area and from short intense periods of localized thunderstorms common to the region.

Numerous damaging floods have occurred during this century in Shelby County. Two of these floods occurred in 1913 and 1959. The 1913 flood event is considered to be the most severe for the region; however, little stage or discharge information is available. The 1959 flood event on the Great Miami River at Sidney had a recurrence interval of approximately 15 years.

Figures 2 and 3 show potential flood heights in Sidney.

2.4 Flood Protection Measures

There are no reservoirs in or upstream of Sidney or levees providing any substantive flood protection to Sidney.

Three low water dams are located along the Great Miami River and Tawawa Creek which do not provide any flood protection to the city.

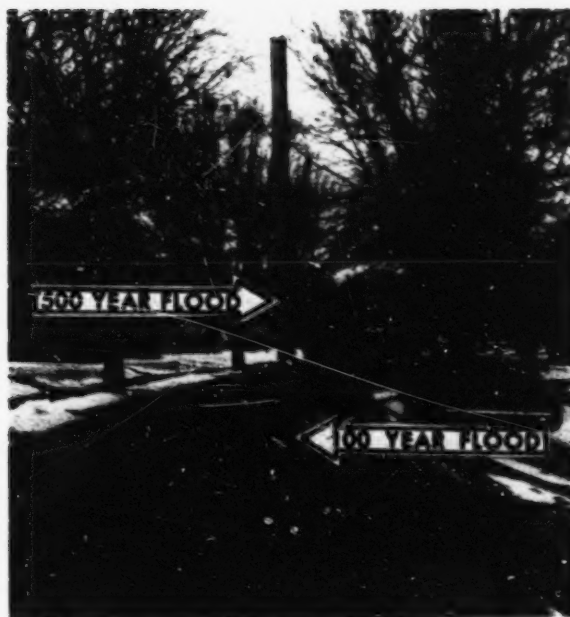


FIGURE 2 - Potential flooding on Crescent Drive south of Bay Street

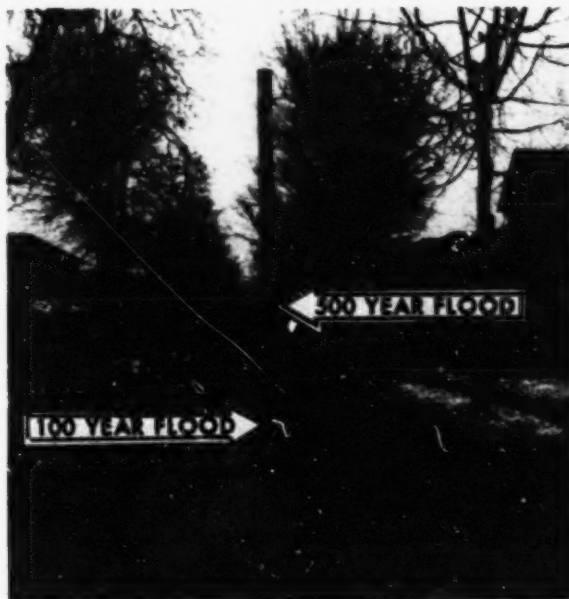


FIGURE 3 - Potential flooding on Miami Avenue at Water Street

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 per cent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one per cent chance of annual occurrence) in any 50-year period is about 40 per cent (four in ten), and for any 90-year period, the risk increases to about 60 per cent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

For the streams studied by detailed methods, an in-depth study of all Ohio U.S. Geological Survey (USGS) gaging stations within the Louisville District was made in accordance with the U.S. Water Resources Council (WRC) Bulletin No. 17A (Reference 3). Initially, there were 73 stations to study; however, 30 of these stations had some modified peaks values through lake regulation. In order to enhance any relationships developed, natural flows were reconstructed whenever possible. Determination of final discharge-frequency curves considered omission of low and high outliers, weighting with the general skew and historically adjusting the curves where possible.

Increasing urbanization within a watershed affects the rainfall-runoff characteristics, and tends to increase flood discharges, in comparison to watersheds where urbanization has not occurred. In addition, the location of the urbanized area within the watershed effects the amount of increase in flood discharges. Other watershed characteristics used in this study were channel slope and watershed drainage area. Based upon these characteristics, discharge-frequency curves were developed for gaged watersheds and related to ungaged watersheds.

The source of the 100-year discharges for the streams studied by the approximate method was the regionalized analyses discussed previously.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (SQ MILES)</u>	<u>PEAK DISCHARGE (CFS)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
GREAT MIAMI RIVER Court Street	541	14,200	22,700	27,000	38,800
TAWAWA CREEK Civic Park Road	53.2	2,020	3,130	3,690	5,160

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross section data for the detail streams were obtained from detailed mapping (Reference 4) modified by aerial photography (Reference 5). The below water sections were obtained by actual field measurements. All bridges, culverts and dams were surveyed to obtain pertinent elevation and structural geometry. Detailed structure plans were obtained whenever possible to document details.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Roughness coefficients (Manning's "n") depend on such factors as type and amount of vegetation, channel configuration and water depth. Field inspection for each stream studied by the detailed method provided estimated values. Technical literature, such as the USGS Water Supply Paper (WSP) 1849, "Roughness Characteristics of Natural Channels" (Reference 6) was very useful. Where available, historical profiles were used to refine these estimated values. This calibration (to the nearest 0.5 foot, where applicable) was useful in improving estimated roughness coefficients on streams without historical profile data. The range of roughness values used for all streams studied by the detail method in Sidney are as follows:

<u>Stream</u>	<u>Overbank</u>	<u>Channel</u>
Great Miami River	.060-.070	.035-.050
Tawawa Creek	.040-.070	.050

The water-surface elevations for the 100-year recurrence interval for streams studied by the approximate method were computed using Manning's formula. Cross sections were based on map reconnaissance only. Constriction at bridges and culverts was not considered. Slope for Manning's formula was based on the streambed profiles obtained from topographic mapping. The 100-year elevation data on all streams studied by the approximate method were based on slope-area computations, or the 100-year backwater elevation from the receiving stream, whichever controlled.

Starting water-surface elevations for all streams studied by detailed methods were determined using slope area computations.

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the HEC-2 computer program, "Water-Surface Profiles" (Reference 7).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps enlarged to a scale of 1:12000 with a contour interval of 10 feet (Reference 4).

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations and the topographic maps referenced above.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). Portions of the floodway of the Great Miami River lie outside the corporate limits.

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
GREAT MIAMI RIVER							
A	125.31	280/130 ²	3358	8.1	926.1	925.2	0.9
B	125.53	320/165 ²	4184	6.5	928.6	927.8	0.8
C	125.76	293 ³	4190	6.5	930.1	929.5	0.6
D	125.83	394/140 ²	5435	5.0	931.9	931.1	0.8
E	126.12	451/150 ²	5274	5.2	933.2	932.3	0.9
F	126.50	390/90 ²	4056	6.7	936.3	935.3	1.0
G	126.63	331/85 ²	4772	5.7	938.1	937.1	1.0
H	126.85	755	8885	3.0	939.5	938.5	1.0
I	127.08	573	6995	3.9	940.4	939.4	1.0
J	127.36	210	2966	9.1	942.0	941.1	0.9
K	127.41	213	3187	8.5	943.0	942.3	0.7
L	127.61	277	4764	5.7	945.5	944.8	0.7
M	127.68	525	6570	4.1	945.7	945.1	0.6
N	127.81	895	10,559	2.6	946.2	945.5	0.7
O	127.92	782	9097	3.0	946.3	945.6	0.7
P	128.23	760 ³	8797	2.8	946.7	945.9	0.8
Q	128.40	417 ³	4523	5.5	946.8	946.1	0.7
TAWAWA CREEK							
A	0.50	219	1035	3.6	946.6	945.7	0.9
B	0.68	120	681	5.4	949.8	948.8	1.0
C	0.91	256	1291	2.9	956.2	955.7	0.5
D	1.11	162	748	4.9	958.7	958.0	0.7
E	1.38	150	734	5.0	963.7	963.6	0.1

¹MILES ABOVE MOUTH

²TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS

³THIS WIDTH IS BEYOND CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SIDNEY, OH
(SHELBY CO.)

FLOODWAY DATA

GREAT MIAMI RIVER - TAWAWA CREEK

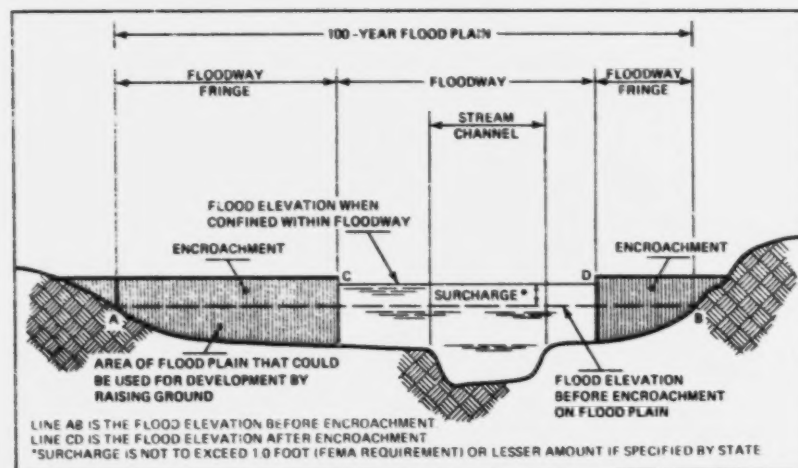


FIGURE 4 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the City of Sidney.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 per cent of the reach.

<u>Average Difference Between 10- and 100-year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Sidney are shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire incorporated area of the City of Sidney was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

- | | |
|---------------|---|
| Zone A: | Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHF's determined. |
| Zones A3, A8: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided. |
| Zone C: | Areas of minimal flooding. |

BEST DOCUMENT AVAILABLE

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Sidney is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

A Flood Insurance Study is currently in progress for the unincorporated areas of Shelby County, Ohio (Reference 8). The results of this study will match exactly the Sidney study.

A Flood Hazard Boundary Map has been published for the community (Reference 9). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, (24th Floor), Chicago, Illinois 60606.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
GREAT MIAMI RIVER							
REACH 1	0002,0003,0004	-3.8	-1.2	3.1	040	A8	VARIES—SEE MAP
TAWAWA CREEK							
REACH 1	0004	-1.5	-0.5	0.9	015	A3	VARIES—SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SIDNEY, OH
(SHELBY CO.)

FLOOD INSURANCE ZONE DATA

GREAT MIAMI RIVER - TAWAWA CREEK

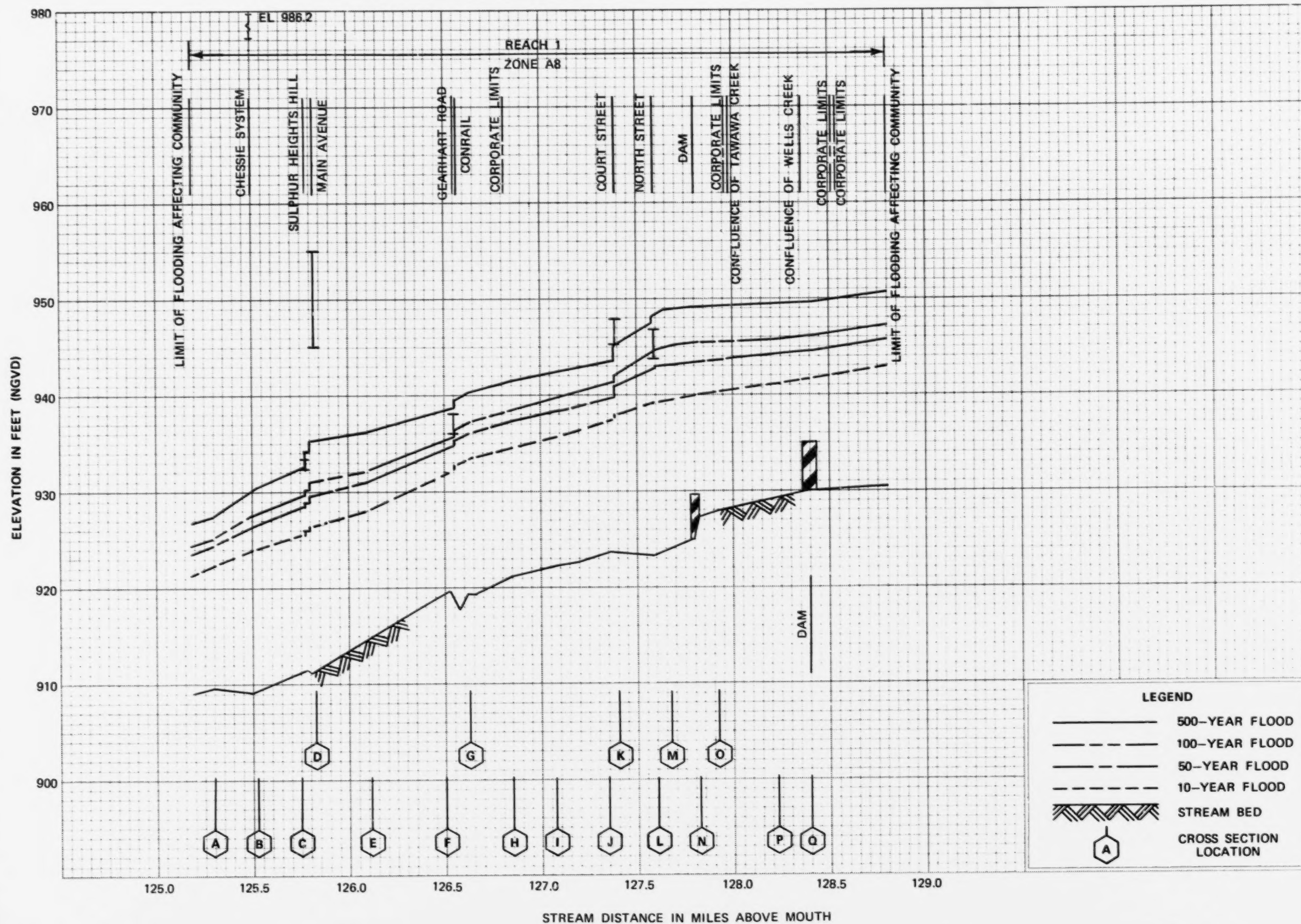
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FEDERAL EMERGENCY MANAGEMENT AGENCY

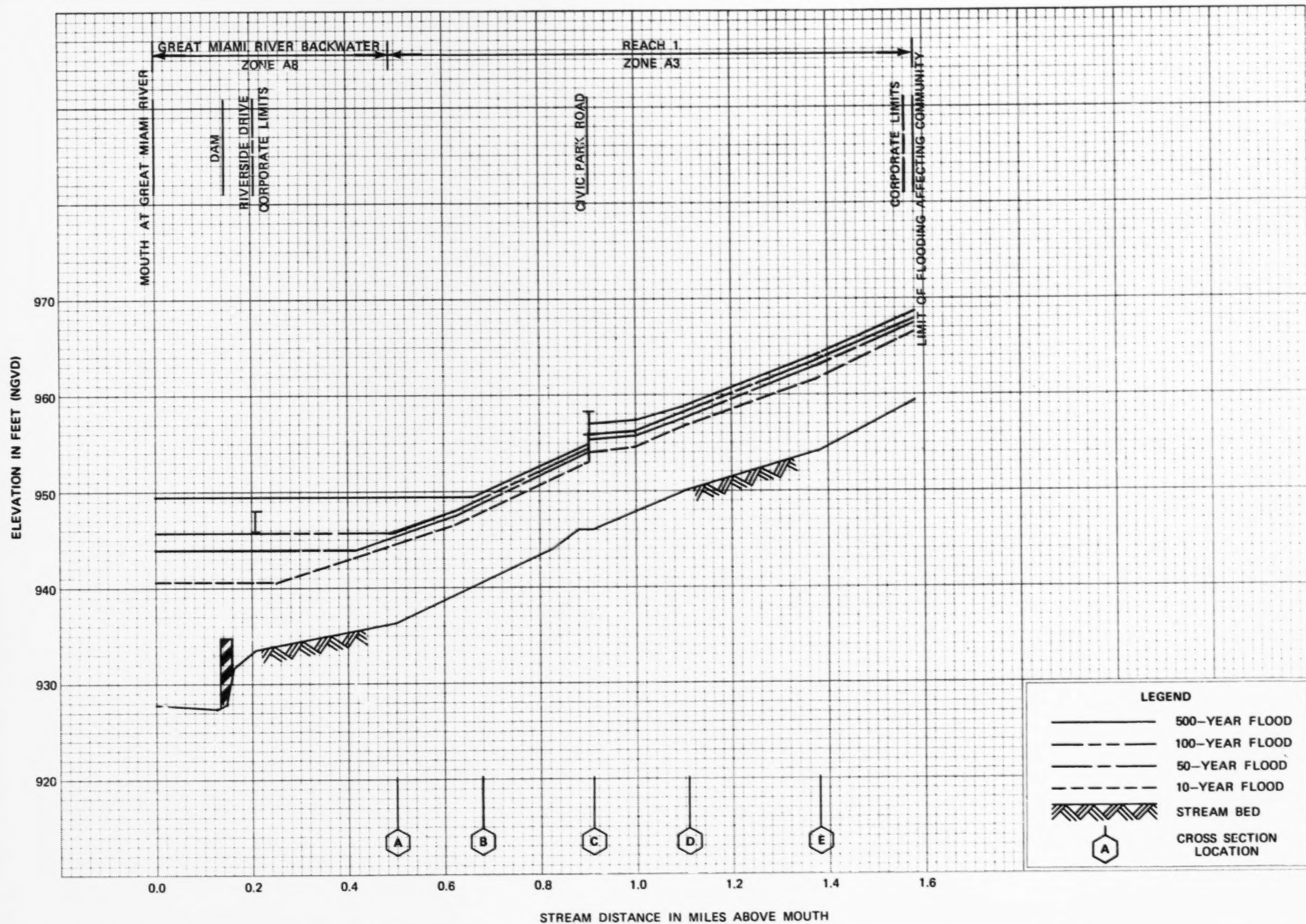
FLOOD PROFILES

CITY OF SIDNEY, OH
(SHELBY CO.)

GREAT MIAMI RIVER

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01P



FLOOD PROFILES

TAWAWA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SIDNEY, OH
(SHELBY CO.)

02P

BEST DOCUMENT AVAILABLE